UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2015/2016 Academic Session

June 2016

EAP412 – Environmental Studies
[*Pengajian Alam Sekitar*]

Duration : 3 hours
[*Masa : 3 jam*]

Please check that this examination paper consists of **NINE (9)** pages of printed materials including **ONE (1)** appendix before you begin the examination.

[*Sila pastikan kertas peperiksaan ini mengandungi **SEMBILAN (9)** muka surat bercetak termasuk **SATU (1)** lampiran sebelum anda memulakan peperiksaan ini.*]

Instructions: This paper contains **SIX (6)** questions. Answer **FIVE (5)** questions only.
***[Arahan**: Kertas ini mengandungi **ENAM (6)** soalan. Jawab **LIMA (5)** soalan sahaja.*

All questions **CAN BE** answered in English or Bahasa Malaysia or combination of both languages.
[*Semua soalan boleh dijawab dalam Bahasa Inggeris atau kombinasi kedua-dua bahasa.*]

All questions **MUST BE** answered on a new page.
[*Semua soalan **MESTILAH** dijawab pada muka surat baru.*]

Write the answered question numbers on the cover sheet of the answer script.
Tuliskan nombor soalan yang dijawab di luar kulit buku jawapan anda.

In the event of any discrepancies, the English version shall be used.
[*Sekiranya terdapat percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.*]

1. [a] Discuss briefly, **FOUR (4)** factors that could influence management of air pollutants from mobile sources.

*Bincangkan dengan ringkas **EMPAT (4)** faktor yang mempengaruhi pengurusan pencemaran udara sumber bergerak.*

[10 marks/*markah*]

[b] Determine the Smoke Density Percentage from the Ringelmann chart reading in **Table 1.**

*Kirakan Peratus Ketumpatan Asap untuk bacaan carta Ringelmann dalam **Jadual 1.***

Table 1 / Jadual 1

2.00	5	5	5	5	2.16	1	1	1	1
2.01	5	4	5	4	2.17	2	2	2	2
2.02	5	3	4	3	2.18	3	3	3	3
2.03	4	3	3	4	2.19	4	4	4	4
2.04	3	3	3	3	2.20	5	5	5	5
2.05	2	2	1	2	2.21	5	5	5	5
2.06	2	1	0	0	2.22	4	4	4	4
2.07	0	0	0	0	2.23	3	3	3	3
2.08	0	0	0	0	2.24	2	2	2	2
2.09	5	5	5	5	2.25	1	1	1	1
2.10	3	4	4	3	2.26	0	0	0	0
2.11	1	1	1	1	2.27	0	0	0	0
2.12	1	1	1	1	2.28	0	0	0	0
2.13	2	1	2	1	2.29	0	0	0	0
2.14	1	1	1	1	2.30	1	1	1	1
2.15	1	1	1	1					

[10 marks/*markah*]

2. [a] There are four phases involved in the rise of a plume of hot gases from a chimney. Describe these four phases.

Terdapat empat fasa dalam naikan jejak asap gas panas dari cerobong. Jelaskan empat fasa tersebut.

[10 marks/*markah*]

[b] Wet scrubbers are often used by the industries as pollution control devices to remove SO_2 emissions from exhaust gas streams. There are two types of wet scrubbers based on the reagent used in the scrubbing process. Differentiate these two types of wet scrubber.

Penggahar basah sering digunakan oleh industri sebagai peranti kawalan pencemaran untuk menghapuskan pelepasan SO_2 daripada gas ekzos. Terdapat dua jenis penggahar basah berdasarkan reagen yang digunakan dalam proses penggaharan. Bezakan kedua-dua jenis penggahar basah ini.

[5 marks/*markah*]

[c] The design conditions for a typical 250-MW power plant burning 1.8% sulphur coal are as follows:.

Rekabentuk tipikal bagi stesen janakuasa 250-MW dengan pembakaran 1.8% sulfur arang batu adalah seperti berikut:

- Flue gas flow: 550 kmol/min (at 425 K and 1 atm)

  Aliran gas serombong: 550kmol/min (pada 425 K dan 1 atm)

- Flue gas characteristic: 1000 ppm SO_2, 600 ppm NOx, 5.5% H_2O, balance nitrogen

  Ciri-ciri gas serombong: 1000 ppm SO_2, 600 ppm NOx, 5.5% H_2O, nitrogen yang seimbang

The flue gas will be treated using scrubber filled with limestone (99% $CaCO_3$). Calculate the limestone rate (in kg/min) that needs to be supplied in order to remove 90% of the SO_2.

Gas serombong akan dirawat menggunakan penggahar berisi batu kapur (99% $CaCO_3$). Kira kadar batu kapur (dalam kg/min) yang perlu dibekalkan untuk menghapuskan 90% gas SO_2.

Assume overall limestone reaction with SO_2 are as follows;

Andaikan tindak balas batu kapur keseluruhan dengan SO_2 adalah seperti berikut;

$CaCO_3 + 2H_2O + SO_2 \rightarrow CaSO_3.2H_2O + CO_2$

(Ca = 40 kg/mol; C = 12 kg/mol; O = 16 kg/mol; S = 32 kg/mol; H = 1 kg/mol)

[5 marks/*markah*]

3. [a] Malaysia has been recognized as a medical hub of the world after being listed in the Best Country in the World for Healthcare in International Living's Global Retirement Index 2015. This is an indication of the development of the medical tourism industry. However, it indirectly affects the rate of medical waste generation. Based on The Guidelines on the Handling and Management of Clinical Waste in Malaysia, describe the main classes of clinical waste and suggest appropriate management method for each class.

Malaysia telah diiktiraf sebagai hab perubatan dunia setelah disenaraikan sebagai Negara Terbaik di Dunia untuk Penjagaan Kesihatan dalam International Living's Global Retirement Index 2015. Ini merupakan petunjuk kepada pembangunan industri pelancongan perubatan. Bagaimanapun ianya secara tidak langsung memberi kesan kepada kadar penjanaan sisa perubatan. Berdasarkan Garis Panduan Mengenai Pengendalian Dan Pengurusan Sisa Klinikal Di Malaysia, jelaskan kelas utama sisa perubatan dan cadangkan kaedah pengurusan yang sesuai untuk setiap kelas berkenaan.

[10 marks/*markah*]

[b] An electroplating factory will be developed at Parit Buntar industrial area. Electroplating is the process of plating one metal onto another by hydrolysis, most commonly for decorative purposes or to prevent corrosion of a metal. There are also specific types of electroplating such as copper, silver, and chromium plating.

Sebuah kilang penyaduran akan dibangunkan di kawasan perindustrian Parit Buntar. Penyaduran adalah proses adaptasi satu logam ke atas satu logam yang lain secara hidrolisis, untuk tujuan hiasan atau untuk mencegah kakisan logam. Terdapat juga jenis penyaduran tertentu seperti penyaduran tembaga, perak, dan kromium.

[i] With the aid of a sketch, propose a typical flow chart of electroplating unit process,

Dengan bantuan lakaran, cadangkan satu carta alir tipikal unit-unit proses penyaduran,

[3 marks/*markah*]

[ii] Suggest the possible hazardous waste/wastewater that will be produced by each unit process

Cadangkan sisa/air sisa yang mungkin akan terhasil oleh unit-unit proses penyaduran tersebut.

[3 marks/*markah*]

[iii] For each type of waste, state the suitable waste code under the FIRST SCHEDULE (Regulation 2) of The Environmental Quality (Scheduled Waste) Regulations, 2005.

Bagi setiap sisa tersebut, nyatakan kod-kod buangan yang sesuai di bawah JADUAL PERTAMA (Peraturan 2) Kualiti Alam Sekeliling (Buangan Terjadual), 2005.

[4 marks/*markah*]

4. [a] Phytoremediation can be used to treat contaminated industrial sites. Differentiate between the phytodegradation and phytoextration mechanism.

Fitopemulihan boleh digunakan untuk merawat tapak perindustrian yang tercemar. Bezakan antara mekanisma Fitodegradasi dan Fitoekstraksi.

[10 marks/*markah*]

[b] Appraise current treatment method of **ONE (1)** waste from a semiconductor industry, and suggest a more sustainable treatment option.

*Nilaikan kaedah rawatan sediada **SATU (1)** sisa daripada industri semikonduktor, dan cadangkan satu rawatan yang lebih mampan.*

[10 marks/*markah*]

5. [a] With the help of a wave diagram sketch; indicate amplitude, period, wavelength and frequency; and state their relationships.

Dengan bantuan lakaran rajah gelombang; tunjukkan amplitud, tempoh, jarak gelombang dan frequensi; dan nyatakan hubung kait antaranya.

[5 marks/*markah*]

[b] Calculate the frequency in MHz of a sound with wavelength of 0.326 m that travels at a speed of $3x10^6$ m/s.

Kirakan frequensi dalam MHz untuk suatu sumber bunyi dengan jarak gelombang 0.326 m dan bergerak pada kelajuan $3x10^6$ m/s.

[5 marks/*markah*]

[c] There are many types of noise analyses. Define ‘octave band’ and state one of its applications in civil engineering.

Terdapat beberapa jenis analisis bunyi. Definisikan ‘jalur oktaf’ dan nyatakan salah satu aplikasinya dalam kejuruteraan awam.

[5 marks/*markah*]

[d] Using the Equivalent Noise Level Contour given in **Figure 1**, predict the loudness of 80 dB at 70 Hz at standard reference frequency. Comment your answer.

*Menggunakan Kontor Paras Bunyi Setara dalam **Rajah 1**, ramalkan kebisingan 80 dB pada 70Hz berbanding frekuensi rujukan standard. Komen jawapan anda.*

[5 marks/*markah*]

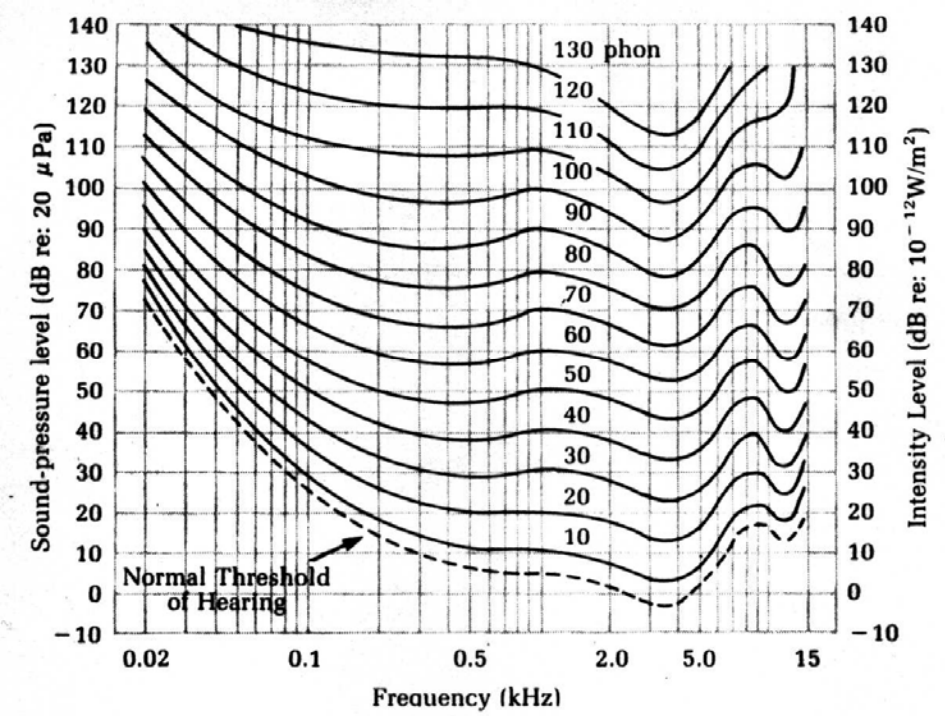

Figure 1 / *Rajah 1*

Fletcher & Munson Equivalent Noise Level Contour/
Kontor Paras Bunyi Setara Fletcher & Munson

6. [a] [i] Define Percentile noise level, L_n

Takrifkan Peratusan Paras Bunyi, L_n

[4 marks/*markah*]

[ii] Determine the L_{50} from the noise monitoring data in **Table 2.**

*Tentukan nilai L_{50} dari data pemantauan berikut dalam **Jadual 2**:*

Table 2 / *Jadual 2*

Time/Masa (s)	dB (A)
10	71
20	75
30	74
40	78
50	80
60	84
70	80
80	74
90	75
100	74

[6 marks/*markah*]

[b] There are many methods that could be implemented to control noise at transmission line. With the help of a sketch diagram, discuss the application of a solid vertical wall in reducing the high frequency noise.

Terdapat pelbagai kaedah yang boleh dilaksanakan dalam mengawal bunyi di laluan penghantaran. Dengan bantuan lakaran, bincangkan aplikasi tembok tegar pugak dalam mengurangkan bunyi frekuensi tinggi.

[4 marks/*markah*]

[c] You are a resident engineer for a construction of a 10 storey hospital project located about 500 m from nearest resident. Discuss **THREE (3)** of the possible noise control mechanisms that could be implemented during the sub-structure stage that involves heavy piling works and other earthworks activities.

*Anda merupakan seorang jurutera residen untuk projek pembinaan hospital 10 tingkat yang terletak 500 m dari penempatan terdekat. Bincangkan **TIGA (3)** mekanisma kawalan bunyi yang mungkin boleh dilaksanakan pada peringkat sub-struktur yang melibatkan banyak aktiviti penanaman cerucuk dan kerja tanah.*

[6 marks/*markah*]

APPENDIX / *LAMPIRAN*

Useful formulae:

1) $C = 20.05\ T^{0.5}$

2) $I = w/s$

3) $L_I = 10 \log_{10} I/10^{-12}$

4) $Lp = 20 \log_{10} (P/Po)$, $Po = 20\ \mu Pa$

5) $Lw = 10 \log_{10} (w/10^{-12})$

6) $Leq = 10 \log_{10} \sum ti\ 10^{\,Li/10}$

7) $L_{wp} = 10 \log_{10} 1/N \sum 10^{\,(Lj/10)}$

8) $L_{pp} = 20 \log_{10} 1/N \sum 10^{\,(Lj/20)}$

9) $T_L = 10\log10 \left\{ \dfrac{s}{\tau 1 s1 + \ldots. + \tau 2 s2} \right\}$

10) $T_L = 10 \log_{10} 1/\tau$

10) NNI = Average Peak Noise Level + $15 \log_{10} N - 80$
Average Peak Noise Level = $10 \log10\ 1/N \sum 10^{\,\text{Peak noise level }/10}$ dB (A)

11) Traffic Leq = $42.3 + 10.2 \log (Vc + 6\ Vt) – 13.9 \log D + 0.13\ S$

12) Traffic Ldn = $31.0 + 10.2 \log [AADT+ T\%\ AADT/20)] -13.9 \log D + 0.13\ S$

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